

P. 6. 8

8

LIFE AND WORK
OF
SIR WILLIAM ROBERTS,

BY
D. J. LEECH, M.D., D.Sc., F.R.C.P.

WITH AN APPENDIX, CONTAINING
A LIST OF HIS PUBLISHED WRITINGS,
COMPILED AND CHRONOLOGICALLY ARRANGED BY
CHARLES J. CULLINGWORTH, M.D., F.R.C.P.

[Reprinted from the "Medical Chronicle," June, 1899.]





Sir WILLIAM ROBERTS M.D. Lond , F.R.C.P., F.R.S.



LIFE AND WORK OF SIR WILLIAM ROBERTS.

SINCE the death of Sir William Roberts, several excellent obituary notices have appeared in which the main features of his career have been portrayed, and the character of his work has been pointed out. But the greater portion of his life was passed in Manchester. Here his influence was most fully felt, and it seems fitting therefore that a fuller record of his life and work should appear in this Journal, of which indeed he was one of the founders, and to the pages of which he was the first contributor.

Sir William Roberts was a member of a family endowed with great vitality. His father, Mr. David Roberts, of Mynydd-y-gof, in Anglesey, who practised medicine and farmed his own land, lived to a ripe age; so also did his mother, a Merionethshire lady.

He himself was the youngest of six sons. Some of his elder brothers settled in Manchester, and two are at the present time leading merchants in this city. The subject of this memoir, though born at Bodedern in Anglesey, received his early education in Manchester, chiefly at the Chorlton High School, under Mr. Kendall; before this at a well-known school in Victoria Park, kept by Mr. Alexander McDougall. He subsequently went to Mill Hill School, and after spending some time at both Dublin and Edinburgh, settled down at University College, London, taking his degree of B.A. at the London

University in 1851, with honours in chemistry and physiology. At University College Hospital he worked under some of the ablest men of the day, amongst them Jenner, Parkes, Walshe and Garrod. In 1854, he graduated in medicine at the University of London, gaining the Medal and Exhibition in chemistry at the first M.B., and the Scholarship and Gold Medal in physiology and comparative anatomy as well as the Gold Medal for medicine at the final M.B. Later on in the year he took the degree of Doctor of Medicine, but prior to this he had spent some time at Paris and Claremont, and in Germany at Bonn and Berlin.

He came to Manchester as House Surgeon to the Royal Infirmary in the latter part of 1854, when he was 24 years of age. After he had held this post for eight months the death of Dr. Bell caused a vacancy in the Medical Staff. At this time the election on the Honorary Staff was often a very serious matter. There were many hundred trustees, all of whom had a vote, and candidates had to establish committees and take means to ensure the attendance of their supporters in order to obtain the coveted position. The poll was conducted like that for a member of Parliament, the expense of a contested election was considerable, and a practitioner locally well known had the best chance of success.

But the academic distinction of the young London graduate and his manifest ability pointed him out as being admirably adapted to fill the vacancy. No one came forward to oppose him, and on the 26th of July, 1855, he was elected Physician to the Royal Infirmary.

The period at which Sir William Roberts joined the Hospital Staff was one of considerable interest in the medical history of Manchester. The attention of the physicians and practitioners here had so far been devoted almost entirely to macroscopic morbid anatomy; morbid histology had attracted but little attention. The chemical enthusiasm excited by Dalton's work had waned, and chemical investigation played but little part in clinical observation. Sir James Bardsley, long the foremost physician in Manchester, had passed his zenith; and

no one had taken up the therapeutic investigations carried on by him. The old theories of medicine still largely influenced practice, and the newest and crudest of them—homœopathy—had gained a large number of adherents in Manchester. There were two medical schools but only one hospital, and clinical teaching was but little attended to.

Sir William Roberts came with advanced views concerning the methods of investigation, and brought into active use in his daily work the test-tube and the microscope; he laboured unremittingly in the wards of the hospital, and he carried out exact and minute observations after the manner of Jenner, Walshe, and Garrod.

All his energies were devoted to clinical work and clinical teaching, and it was in the wards that he laid the foundation of his future success. Soon after joining the Hospital Staff, he was made a lecturer on anatomy and physiology at the Pine Street School of Medicine, and gave a course of lectures on physiology, but in 1859 he undertook the lectures on pathology, and these he continued to give until 1863.

The subject of paralysis with wasting of the muscles had, since 1850, attracted much attention on the continent; but in England this condition had scarcely been recognised as a special form of disease, though cases had been published. For three years Roberts paid special attention to this form of ailment, and then made his first appearance as an author by publishing, in 1858, an "Essay on Wasting Palsy."

He suggested, however, that in compliment to the venerable professor of pathology who had written an important memoir on the subject to the Paris faculty, it might well be called Cruveilhier's Paralysis, and the name was adopted by many subsequent writers. The Essay, which contains a record of all previously recorded cases and of many under his own care, is a model of careful observation and clear diction. He states in the preface that Dr. Parkes went over the entire manuscript, and in later times he used to tell how Parkes cut out all his "fine writing" in this his first book. It certainly is wanting

in those quaint remarks and methods of expression which were as natural to his pen as to his conversation.

On comparing this monograph with the present accounts of the various forms of muscular atrophy, one is struck by the wonderful accuracy of the clinical descriptions which are given. In recent years, muscular atrophy has been sub-divided into a number of groups, each having a different pathology, and it is interesting to find the chief clinical varieties recognised by Sir William Roberts so long ago. Thus he draws attention to one group of cases commencing with wasting in the small muscles of the hand—cases which would now be described as progressive muscular atrophy, or amyotrophic lateral sclerosis. He also pointed out that in another group the wasting commences in the shoulder muscles and upper arm muscles, and that the hand and forearm muscles are spared,—cases which are now described by the name, idiopathic muscular atrophy (scapula-humeral type). Illustrations are given which show almost as clearly as those in the most recent works, the *broad* clinical features of idiopathic muscular atrophy, and progressive muscular atrophy. Even the myopathic face in idiopathic muscular atrophy did not escape his notice.

After discussing the pathology, he concludes that the changes originate in the muscles themselves; and this is still the view generally held with regard to one important group of which he treats—the cases now described as idiopathic muscular atrophy. But in other groups, microscopical examination has now revealed changes in the ganglion cells of the anterior horns (progressive muscular atrophy, chronic anterior poliomyelitis) or in the anterior horns and the crossed pyramidal tracts (amyotrophic lateral sclerosis).

In the forty years which have elapsed since Sir William Roberts's work on wasting palsy was published, various groups have been recognised, and definite names given to them; microscopical examination has revealed changes in the spinal cord or nerves in certain cases; but in others, the result of examination of the nervous system is still negative; very little more is known as to the exact treatment or the causation,

and it is interesting to find the broad clinical features of the most important varieties so clearly described in this excellent monograph published long ago.

The book established his reputation as an able observer and writer, but though a paper on some of the more unusual forms of paralysis, in the *Medical Review* for 1860, shows that he continued to pay attention to neurological subjects, it is manifest that work for which his skill as a chemist and microscopist more specially fitted him, attracted his chief attention after his book had appeared.

Between 1858 and 1865, when he published his treatise on urinary and renal diseases, he devoted much of his time to researches on points connected with urinary changes and diseases of the kidney. The wards of the infirmary, though furnishing abundant scope for clinical enquiry, gave no opportunity for chemical research, and but little for microscopic investigations. Hence he had to provide a workroom of his own, in which both could be carried on.

In 1858 he described a case of cystine calculus, and the method of determining the amount of sulphur in cystine. In 1858-9 he communicated to the Literary and Philosophical Society of Manchester, and afterwards to the *Edinburgh Medical Journal*, a series of observations on the normal variations in the reaction of the urine, pointing out the influence which food has on the reaction, and he advocated, in a paper in the *British Medical Journal*, 1860, the exclusion of sugar from the diet of diabetics, in opposition to Dr. Budd of Bristol who had thrown doubt upon its advantages.

He contributed, a little later, to the same journal, a paper on crystallised phosphate of lime in the urine, the presence of which, in large quantities, he thought of evil omen; but his most important contributions were on the quantitative estimation of sugar, and the solution of uric acid deposits and calculi. In October, 1860, he introduced, in a paper read before the Literary and Philosophical Society of Manchester, a new method of estimating the amount of sugar present in urine, by fermentation. By a series of careful chemical investigations

he showed that each degree in specific gravity lost when diabetic urine is fermented indicates the presence of one grain of sugar in a fluid ounce of urine. His investigations were published to the medical world in the *Edinburgh Medical Journal* the following year, and long experience has proved the exactness of his observations.

The subject of the solution of uric acid calculi greatly interested him. In 1861, he pointed out at a meeting of the British Association, the solvent effect of alkaline carbonates on uric acid calculi, and he continued to make observations on this subject for many years. He showed the kind and amount of alkali which should be taken to exert the greatest effect, and demonstrated the freedom of alkaline treatment from all ill results when suitable precautions are observed.

The data furnished by him concerning the solution of uric acid and urates are the chief source of our knowledge on the subject of the medicinal treatment of calculi and gravel, and largely influence practice at the present time, although perhaps the advances in renal surgery made in recent years have somewhat limited the necessity for attempting the solution of renal calculi.

Besides working specially at questions relating to the kidney and its secretions, many other subjects claimed his attention from time to time. Homœopathy had become very popular amongst the laity of Manchester, and there were a certain number of medical men who, from want of knowledge, or from keenness of desire for patients, were willing to pose as practitioners in homœopathy. It became evident, however, especially to those engaged in consulting practice, that one or two of the homœopathists who were most successful did not attain their reputation by the use of infinitesimal doses. Many prescriptions purporting to be homœopathic in character came under Sir Wm. Roberts's notice, and in some of these large doses of powerful drugs were given.

In 1862 he issued a brochure on the subject of homœopathy, in Manchester, dealing with the subject in his happiest style.

He showed clearly the fallacies in the claims of homœopathic practitioners, and dealt with the absurdities of the doctrine of homœopathy in a light and satirical manner; nevertheless, a more crushing indictment of homœopathy was probably never penned. Though the pamphlet has a local impress, it is well worthy of study, even now, by any one who wishes for information on the fallacies of homœopathy

He wrote several papers on subjects connected with scientific medicine. In one he discussed the influence of iodide of potassium in aneurysms. In another, communicated to the Royal Society, he recorded the action of tannic acid on the red blood corpuscles, and pointed out that magenta stains the nuclei of the white corpuscles, and, in animals in which the red cells are nucleated, those of the red corpuscles as well.

Besides papers to the Journals he made many communications to the Medical Society of Manchester, of which he was honorary secretary during the years 1859-63, and President in 1865. Possessing a thorough knowledge of French and German, he kept himself well abreast with the advances of medicine on the Continent, and led the way in the application of new discoveries to practice. In 1864 his enthusiasm nearly led to his early death. As soon as Wunderlich had published his well known observations upon the use of the thermometer, Roberts proceeded to test its value for diagnostic and prognostic purposes, in all kinds of ailments but especially in fever. At the time there was an epidemic of typhus in Manchester, and he and the resident medical officer of the Royal Infirmary, Dr. Day, were struck down by this fever about the same time.

The resident medical officer died, and Roberts narrowly escaped with his life. He was delirious for more than a fortnight, and had it not been for the unremitting attention of his friend, Mr. Thomas Windsor, it is probable his career would have prematurely ended.

The practical Treatise on Urinary and Renal Diseases including Urinary Deposits, which appeared in 1865, was the outcome of much labour and research, and at once took a high

place in English medical literature. It was not only well abreast of continental work, but contained the results of experiments and observations which the author diligently carried on for nearly ten years. Incorporated in it are summaries of experiments made on the density, amount and oscillations of the kidney secretion, and on the influence of food on its alkalinity. A full account was given of the estimation of sugar, and the exact methods to be used in the solution of calculi.

The urinary deposits were in nearly all cases described and delineated from specimens prepared by the author, and all the methods of examination alluded to showed his complete familiarity with every detail of investigation. He even describes and depicts a new and commodious stand for the apparatus, and this stand is at the present time in use at the Manchester Royal Infirmary.

By his communications to the Medical and Scientific Societies in Manchester, the work on which he was engaged became widely known, and he often had the opportunity given him of seeing the rarer forms of renal disease occurring in private practice in Manchester and the neighbourhood; whilst at the Manchester Infirmary, with its large out-patient department, there was a great field for observation. He was thus enabled to add to existing knowledge concerning the less frequently seen forms of disease, such as cystic and tubercular affections of the kidney, and chyluria. He was able, too, to adduce cases throwing light on almost every form of kidney disease. His account of the various renal ailments was manifestly founded on, or at least guided by, his own observations, hence the value of the work, and this was enhanced by the manner in which it was written; the English was crisp, clear and concise.

The issue of this valuable treatise marked an important epoch in his career. For a short time after he came to Manchester he had lived in Oxford Road, a little later he went to reside in Chatham Street, a quiet quarter, close to the Infirmary, well fitted for his work, but not calculated for the publicity which physicians are supposed to require.

Consulting practice did not at first come quickly, but he was content to work and wait ; gradually his abilities were appreciated, especially by members of the profession. It was not until 1864 that he took a house in one of the leading thoroughfares of the town—Mosley Street. Here, especially after the issue of his “*magnum opus*,” as he called his treatise, his consulting practice rapidly increased. In his new home he established his workroom, and here until his marriage in 1869, all his spare time was spent, with his books, his microscope, his chemical apparatus, and the inevitable cigarette. Working on many subjects, he still devoted a large portion of his time to observations on renal disease, and in 1868 he opened up a new chapter in affections of the urinary tract, by his paper on obstructive suppression of the urine, in which he showed that the effects due to the blocking up of both ureters were quite different from those of suppression connected with kidney disease, and pointed out the symptoms of a rare pathological condition not hitherto recognised.

Elected a Fellow of the College of Physicians in 1865, he was appointed Goulstonian Lecturer in 1866, and gave a discourse on the use of solvents in the treatment of urinary calculi and gout, a subject in which he always took deep interest, the more so because he recognised in the solvent action of the alkalis an instance in which therapeutic advance was the direct outcome of chemical knowledge. To this he makes an interesting allusion in the only introductory address he seems to have delivered, on the place of medicine among the sciences.

In 1872 he issued a second edition of his *Treatise on Urinary Diseases*, adding thereto an account of obstructive and non-obstructive suppression. He mentions Dr. Currie Ritchie as having assisted him in the work of supervision. Four years later a third edition was called for, and in this he incorporated recent work with regard to uræa estimation, and propounded a plan for the estimation of albumen in urine by diluting it with water, and noting the amount of dilution required to prevent any evidence of precipitation by nitric acid. The views of Gull and Sutton with regard to arterio-capillary fibrosis, so far as they

bear on diseases of the kidney, were set forth and discussed, as well as those of Dickinson on brain changes in diabetes. A few minor alterations were also made, but considering that ten years had elapsed since the first edition, the additions and alterations required were very slight.

Two or three years later, in 1879, he contributed a series of articles on Diseases of the Kidney to "Reynolds's System of Medicine," which were mainly founded on the chapters in his book on these subjects, though some of them contained additional knowledge which his large and constant experience in the treatment of renal diseases enabled him to acquire, for he was now one of the leading authorities in England on his subject, and had long been the physician in the North of England to whom renal cases had chiefly gravitated.

But he by no means limited his attentions to renal diseases. He was constantly working at other subjects, and was specially interested in points connected with practical therapeutics, making in this direction several contributions of great value.

In 1868 he published a paper on tapping with the aid of syphon power, pointing out the advantages which were likely to result from a modification of an apparatus devised by Mr. Spencer Wells for removing abdominal and ovarian fluid. Subsequently he devised a special syphon tapping apparatus, which he described at the Manchester Medical Society in December, 1868, and afterwards in the Manchester Medical and Surgical Reports for 1873. This apparatus is still largely used, and has never been surpassed in simplicity and utility.

He likewise designed a pad for the application of continuous cold or heat to the surface of the body. It consisted of a close coil of very thin indiarubber tubing, $\frac{3}{8}$ ths of an inch bore, cemented by a strong canvas backing, through which water of any temperature could be passed. He had pads of three sizes made, and gave an account of their use, with illustrative cases, in the *Medical Times and Gazette*, December 16th, 1871.

A few years later, he designed a respirator inhaler to facilitate the use of topical applications to the respiratory

tract, and the administration of remedies by absorption through the pulmonary surfaces. It consisted of a shallow tin box, of the size and shape of the ordinary respirator, the top and bottom being perforated with holes, and the box itself fitted with some porous material on which the substance to be inhaled might be poured. The top being hinged, the porous material could be readily removed, and the whole instrument kept clean. No more useful respirator inhaler has ever been invented, and it continues to be largely used where treatment by inhalation through the mouth alone is thought sufficient.

In 1869 he married Miss Elizabeth Johnson, younger daughter of Mr. Richard Johnson, of Fallowfield, and went to reside at Bowdon, where he lived until he left Manchester for London, using the house in Mosley Street for his medical and scientific work. Unfortunately his domestic life was clouded by several sad events. Within a few years of his marriage, his wife's health failed. He gave up his practice in order that he might go with her to San Remo. Here they resided for several months, but unfortunately without benefit to Mrs. Roberts, for she died in 1874, a few months after her return, leaving a son and daughter. The daughter died in childhood shortly after her mother, whilst the son was cut off when just entering into manhood in 1893.

Engaged though he was from 1865 onwards, in a large consulting practice, and busily occupied with clinical observations and contributions to therapeutics, he nevertheless found time to enter with vigour on biological investigations. Some time before 1870, a controversy arose as to the origin of certain of the lower forms of life. Pasteur and Lister had pointed out the importance of some of these organisms, but the views with regard to their method of production, and the part they play differed. Some held that micro-organisms always spring from organisms like themselves; others considered that they might arise *de novo*, from the media in which they grow.

With the former opinion (panspermism) was associated the view, that by preventing the entrance of germs into media, their growth therein, and the evils arising from that growth,

might be prevented. But if these organisms could be formed in media, without the introduction of germs from outside, if abiogenesis were true, then they must be considered, not as the cause, but as the consequence of changes in fluids and tissues, and the prevention of their entry was of less importance.

Roberts took up the study of the question as regards bacteria and torulæ, and for four years in his little workroom in Mosley Street, carried out a series of experiments to decide the question, by finding out under what conditions he could prevent the growth of organisms in fluids in which they would ordinarily appear—infusions of hay and other vegetable matters, blood, urine, etc. His results published in the *Philosophical Transactions of the Royal Society, London*, 1874, led him to the conclusion that normal tissues and juices have no inherent power to originate organisms, and that when organisms appear therein, their development is due to germs imported from without.

With the fairness which marked all his work, he detailed every experiment which he was unable to explain completely on this view, and with a caution which was also characteristic, he added, that though these exceptional results did not permit of a deduction in favour of abiogenesis, "they certainly impose a reserve which is highly significant."

During the next three or four years he continued working on the lower organisms, and the discovery by Professor Cohn of Breslau of the great power which spores have of resisting heat, together with his own observations, threw light on the experiments which had imposed the reserve. In his address in Medicine at Manchester in 1877, on the Doctrine of Contagium Vivum and its applications to Medicine, he announced his complete agreement with the doctrine of panspermism. "The organisms which appear as if spontaneously in decomposing fluids, owe their origin to parent germs derived from the surrounding media," and he further expressed his opinion that a contagium, at least in the immense majority of cases, consists of an independent organism or para-

site, bringing forward the facts connected with septicæmia, relapsing fever, and anthrax as illustrations. To account for the different effects which bacteria apparently similar morphologically produce, he suggests that under certain conditions, even the common bacterium of putrefaction may become modified in such a way as to be endowed with a heightened capacity for growing in healthy tissues; that at times "sporting" or "variation" occurs, and that just as the bitter almond is a "sport" from the sweet almond, so an ordinary septic bacterium may become capable of causing infection. He thought it possible that diphtheria might be a "sport" from the micro-organisms of scarlet fever, and that cholera and typhoid fever might have arisen from some harmless predecessor.

Biological problems were always passing through his mind; he was an enthusiastic gardener, and loved to watch the phenomena of plant life. About 1880 he bought a large estate in Wales, at Bryn, about four miles from Machynlleth, and after this always spent several weeks of each year there, coming back often with new ideas concerning the animal and vegetable world.

Shortly after the delivery of his address on *Contagium Vivum*, he seems to have turned his attention to a new series of investigations; that is, to an examination of the digestive ferments.

In this, as in previous subjects, he started from an experimental basis, and in the first place examined the digestive ferments in his laboratory, repeating and extending the work which Kühne and others had done on the continent.

He made the discovery that the pancreas contains a milk-curdling ferment in addition to trypsin, and communicated this fact in a note to the Royal Society. In the same year he gave an address to the Lancashire and Cheshire Branch of the British Medical Association at Northwich on the Digestive Ferments and their Therapeutical uses, which was subsequently published in the *British Medical Journal*. In this paper, after describing the various ferments and setting forth his views as

to the methods in which they act, he gave an account of the therapeutic uses of the pancreatic secretion which has had a wide influence on English medical practice.

He had prepared for him by Mr. Bengier, a well known Manchester chemist, an aqueous extract of the gland in water, with just enough spirit added to keep it from decomposition. He gave to this the name of "liquor pancreaticus," and pointed out the proper methods of using it.

It was in this address, too, that peptonised milk, now so extensively employed, was introduced as an article of diet. He described minutely the methods in which peptonised food might be made, either by the peptonisation of milk itself, or of a mixture of gruel and milk, and so accurate were his observations that, though twenty years have elapsed, the methods he described then were those which may be most advantageously employed now.

In 1880, he was appointed Lumleian Lecturer at the Royal College of Physicians, and chose for his subject the Digestive Ferments and the preparation and use of artificially digested foods.

In these lectures, which were subsequently published in a separate form, he entered fully into the action of digestive ferments, and the methods in which pre-digested foods might be prepared for use.

He gave proofs of their nutritive value, and illustrated their dietetic utility. A little later he contributed an article to Quain's Dictionary of Medicine on "Peptonised Food," and communications to the Royal Society "On the Estimation of the Amylolytic and Proteolytic Activity of the Pancreatic Extracts," and to the International Medical Congress of 1881 "On Some New Articles of Peptonised Food," show that he continued to work experimentally on digestive ferments.

He proceeded after this to examine the influence of food accessories, such as wine, tea, and coffee on the action of these ferments. In a course of lectures given at Owens College in 1885, he recorded the results of his examination. He gave details of a very large number of experiments *in vitro*, showing

the effect of food accessories on salivary, peptic and pancreatic digestion, and pointing out that notwithstanding such accessories are more or less used by all nations, and seem to be essential to the comfort of mankind, their common effect is to retard the digestive processes. He threw out the interesting suggestion that this retardation may not be wholly, or even at all an evil, but that probably it has been rendered necessary owing to the fact, that with the advance of civilisation, food has been constantly rendered more digestable by the processes of preparation. Too rapid digestion of food would result in a waste of material, hence it is perhaps desirable that "the digestive fires should be damped down in order to ensure the economical use of food."

The final section he devoted to acid dyspepsia and its treatment, and in it we find a suggestion which has met with considerable acceptance, viz., the use of lozenges to promote increased secretion of saliva, by which recourse to the use of alkalies may be to a large extent avoided.

The effect of alcohol on the individual, and on the race, was a subject of great interest to him. He was strongly impressed with its evils, and controverted some statistics of Dr. Dickinson's which seemed to cast doubt on the effect of alcohol in the production of Bright's Disease.

But his experiments and observations led him to the conclusion that alcohol had its uses as an article of diet, and in an address on Collective Investigation of Disease, he suggested the necessity for the acquisition of more exact statistics as to the influence of alcohol, pointing out the interesting fact that whilst amongst civilised communities there is nowhere seen so much physical, moral, and intellectual ruin of individuals from alcohol as in this country, yet the national death rate is low, and the moral and intellectual vigour of the race is high; and further, that the nations abstaining from the use of alcohol—the vast Mussulman population and other millions of Asia—are, upon the whole far inferior to the alcohol-bred races of the West. The Japanese are the only Asiatic people who have for centuries consumed alcohol largely, and they display a mental recepti-

vity and love of progress, which are in marked contrast to the stagnation around them.

The curious difference between the apparent influence of the consumption of alcohol on the individual and the race, was a subject which he often referred to and discussed. He maintained that the general use of alcohol in some form, amongst almost all nations, is an indication that it must be of some real service to man, and that on scientific ground there is evidence that this is the case. On more than one occasion he controverted ultra-opinions expressed as to the advantages of total abstinence, but he did not often allude in his writing to the advantages of alcohol, fearing lest he might create a wrong impression on the subject.

As President of the Therapeutic Section of the Cardiff Meeting of the British Medical Association in 1885, "Feeding the Sick" formed the subject of his opening address. In it he laid stress on the desirability, when prescribing food in sickness, of adhering to the main features of the current dietetic habits, and avoiding irksome and needless restrictions, for which no clear reason can be given. He held that the peculiarities and idiosyncrasies of the invalid stomach should be considered. "In adapting diet to idiosyncrasies," he says, "it is a good rule, as far as practicable, to lessen the quantity of offending articles, rather than to forbid them altogether, or if they must be forbidden, to provide in their place, substances of kindred nature."

In an address which he delivered some years later to the Medical Society of Manchester, he is still more emphatic in his condemnation of unnecessary dietetic restrictions, and lays much stress on the necessity for closely observing each patient's idiosyncrasies. He insists that the only true basis of a scientific knowledge of dietetics is to be found in a painstaking and unprejudiced study of the food, customs, and habits of mankind. One of the characteristics of national dietary is, its variety or diversity, which doubtless serves some useful end. We are not justified, he says, in neglecting this feature, and in reducing the diet to a dead level of monotonous uniformity.

He thinks we often needlessly torment and worry our patients by placing unnecessary restrictions on their choice of food, and he expresses the opinion that a large number of the restrictions commonly laid down in dietetics, are grounded on crude notions floating through the lay press, and unconsciously lodged in the medical mind. He suggests, as a good rule, that when there are no special indications to fulfil, the diet prescription should largely depend on what the patient likes, and what agrees with him. The palate, he held, is placed like a dietetic conscience at the entrance gate of food, and its appointed function is to pass summary judgment on the wholesomeness or unwholesomeness of the articles presented to it. It acts under the influence of an instinct, which is rarely at fault. But there are, he says, eccentric or misfitting palates that appear as if they belonged to somebody else; palates that are altogether perverse and depraved, and habitually betray their hosts. It is the business of the medical adviser to diagnosticate these eccentric or vicious palates, and assist their owners by judicious counsel.

In his "Collected Contributions on Digestion and Diet," published in 1891, a full account of his experiments and views on digestion and diet will be found.

Although contributions to our knowledge of food and feeding formed the main portion of his contributions to literature for several years after his attention was directed to the subject, he yet found time to write on many other subjects pertaining to clinical medicine. His attention had been directed in 1870 to the motiveless simulation of disease by an extraordinary case under his care in the Infirmary, in which a boy had for a long time raised blood mixed with extraordinary pieces of fibrous tissue, which on examination proved to be portions of the thoracic aorta (probably of a sheep). Though carefully watched at home it had been found impossible to ascertain whence they had been derived. He recorded with this case several other instances of a similar kind in the *British Medical Journal*, and in 1879 published a further paper in the *Practitioner* on "Hysteria in Boys," in which he discussed the nature of hysteria, and suggested the use of the word

“hysteroid” instead of hysterical for such manifestations as he had described. He likewise communicated at the International Medical Congress in London, in 1881, the history of a case of bacilluria, and wrote two papers on the tests for albumen. In one of these he advocated a mixture of saturated solution of common salt, with five per cent. of dilute hydrochloric acid, as the best test for albumen, on the ground of its convenience and certainty, but he subsequently withdrew his commendation of the test because of its undue delicacy, and recommended instead a mixture of one volume of strong nitric acid with five volumes of a saturated solution of sulphate of magnesia as the most useful and convenient test.

The last edition of his book on renal and urinary diseases was published in 1885, but he was too much engaged in other work to devote to it the time necessary for making those additions to it which the increase in pathological and chemical knowledge relating to the kidney and its secretion called for, and he therefore associated Dr. Maguire with himself in preparing the fourth edition.

In 1883 he resigned his connection with the Infirmary, which had continued for nearly thirty years. He had done much to systematise the clinical teaching there, and an excellent clinical pocket-book for the use of students which he published shows the interest he took in this subject. The calls on his time, entailed by a large consulting practice and his scientific work, had long prevented him devoting the time he once did to teaching in the wards. Nevertheless his loss was greatly felt, for he was an admirable clinical teacher, exact and systematic in his examination of cases, quick in grasping and pointing out the relative importance of symptoms, and clear and concise in his instructions and explanations.

He did not resign his connection with the Owens College which had long been rather nominal than active. He always disliked undertaking a series of formal lectures, and though appointed Lecturer on Medicine in 1863, and one of the Professors of Medicine from the time of the union of the Medical School with the College, in 1873, he soon left to his

co-professor, Dr. Morgan, the duty of giving the whole course in medicine, and in 1876 resigned the Chair of Medicine, and was appointed Professor of Clinical Medicine. After the Victoria University was established, he took part in the organisation of the medical department, and again became one of the Professors of Medicine. But when the power of granting degrees had been recognised, and the department organised, he only gave one short course of lectures, and did not take an active part in the work of the College or University. This led to a curious incident in connection with the knighthood conferred on him in 1885.

A letter had been addressed to him at the Victoria University, relating to his acceptance of the honour, but he was a rare visitor at the College, and by accident the letter was not forwarded to him. Hence no reply was sent. This must have been taken as a sign of acquiescence, and he received the first intimation of the honour to be conferred upon him from a paragraph in the morning paper. He thought that some error had been made, and it is said that he went to the office of the paper to have a contradiction inserted, but was assured there was no error. There is reason to believe that if he had been allowed the opportunity of a decision he would have hesitated to accept the proffered honour, for he was singularly careless of all honours, and regarded knighthood rather as an inconvenience than as a matter of congratulation.

After 1885, Sir William Roberts' contributions to medical literature show that his attention was very largely directed to the effect of the presence of uric acid in the system, and also to gout, and its causes. His first contribution appears in the seventh volume of the first series of the *Medical Chronicle*. He confirmed the views of Dr. Bence Jones that the amorphous urates commonly present in the urine are neither urates nor bi-urates, but quadri-urates, which are gradually decomposed in the presence of water, uric acid being set free. He showed further that the saline constituents of the urine tend to inhibit the decomposition of the quadri-urates, and suggests that deficiency of salines in food lead to uric acid gravel and

calculi, and that the advantage which seems to be derived from an abundance of salt food, when there is a tendency to calculus disease, is due to the increased power which the addition of saline constituents impart to the urine of delaying the decomposition of the quadri-urates.

He continued actively engaged in experimental work relating to uric acid and gout for many years, but published nothing further on the subject until after he left Manchester in 1889.

He had for some time contemplated this movement, being urged thereto by the heavy calls on his time and strength which a large consulting practice involved, by his desire for more time for scientific work, and by his wish to make a home in London for his son, who was now advancing towards manhood.

Whilst in Manchester he had avoided taking an active part on councils, committees, and all public bodies, but in London he at once took up official administrative work. He had been on the Council of the Royal College of Physicians in 1882, and the two following years, and in 1889 and 1890 he was one of the censors.

He was appointed a Fellow of the University of London, and became an active member of the management of the Brown Committee, of which he subsequently became chairman, but he continued to work energetically in the laboratory which he had established at his new home in Manchester Square, on problems connected with gout and allied ailments. He communicated papers on subjects relating to gout to the *British Medical Journal*, the *Lancet*, and the Medico-Chirurgical Societies of London and Nottingham. In that which appeared in the *Lancet* he showed the fallacy of a test for latent gout introduced by D. E. Pfeiffer. The Croonian Lectures which he delivered in 1892, before the Royal College of Physicians, set forth the result of researches extending over many years.

By a laborious series of experiments he had ascertained the changes in uric acid combinations which are liable to occur in the system, and was thus enabled to throw light on the etiology

and treatment of gravel, calculi and gout. He had found that uric acid in the presence of an alkaline fluid is converted into a quadriurate, and that it is in this form uric acid exists in the blood and is excreted in the urine. He pointed out that not only will excessive excretion of urates tend to deposition of uric acid, but also those conditions which favour the decomposition of the urates. That amongst these, undue acidity of the urine and poverty in saline constituents are the most important, and that we have in this knowledge a guide to the treatment and prevention of uric acid gravel and calculi.

He also showed how quadri-urates can be converted into bi-urates, and determined experimentally the conditions which facilitate the deposition of bi-urates of sodium in the blood. He discovered that the solubility of the bi-urates is greatest in water, and that the addition of saline substances to a fluid decreases its power of dissolving the bi-urate. He also found that sodium salts tend to the changes leading to deposition of bi-urates in the tissues, whilst potassium salts do not.

Many other points bearing on the cause and treatment of what he calls uratosis, or the deposition of urates in the tissues, came to light during his experiments, which afford more information concerning the nature of gout than any which have been recorded since Sir Alfred Garrod proved the causal relationship between uric acid and gout.

The general results obtained by Sir William Roberts and the therapeutic lessons to be drawn from them are embodied in the excellent article on gout which he contributed to Dr. Clifford Allbuts' system of Medicine in 1897. He advocates therein the dietetic substitution of chloride of potassium for chloride of sodium in chronic gout, and throws doubt on the utility of alkalies, including lithia and piperazin. He explains the occurrence of the acute attacks which often occur when those predisposed to gout drink the mineral waters at Spas, by the increase of saline material in their body fluids, which, his experiments show, tends to the deposition of bi-urate of sodium from any fluid in which it is contained.

It is interesting to note that he regards uric acid, when

in the blood and fluids, not as a poison, but as doing harm by causing the deposition of bi-urate of sodium in the tissues on the one hand, or of uric acid in the pelvis of the kidney or bladder on the other. He suggests that not only are the more patent evidences of acute and chronic gout due to uratic deposits in the tissues, but that the minor manifestations have the same cause, and thinks that the troubles, external and internal, often present in gout, are due to the presence of minute crystals, and not, as is often supposed, to some poisonous property pertaining to uric acid.

He strongly combats the views of Ebstein that the neutral urate of soda is at first deposited, and by its irritant action injures the tissues, and renders them susceptible to inflammatory charges—such a deposit, he held is impossible. It is the bi-urate which gives rise to the phenomena of gout.

In 1893 Sir William Roberts was appointed one of the members of a Royal Commission constituted for reporting on the nature and extent of the evils arising from the consumption of opium in India, and with other members of the Commission visited India for the purpose of taking evidence. His wide knowledge of disease and freedom from bias, rendered him well adapted for coming to a correct opinion as to the effect on health which opium produces. The report on the medical aspect of the opium question, which is in the sixth volume of the final Report, was drawn up by him, and dissipates many of the myths which had found currency as to the extent of the injury inflicted by opium. The conclusion he arrived at was that the health of opium eaters, provided they keep within their tolerance, is just as good as that of other people. The drug does not affect longevity usually, though undoubtedly excess interferes with the usefulness of those who indulge in it, but an "opium sot" is rarely seen. It does not commonly lead to suicide or any other form of insanity. On the other hand it is largely used as a domestic remedy in a variety of ailments, as well as a euphoric agent, and it could not be replaced by any known drug.

The report of the Commission has no doubt had a most

useful influence in calming the fears at one time prevalent with regard to our responsibility for the consumption of opium in India. Whilst in India, Sir William Roberts' attention was called to the possibility of using anarcotin as a therapeutic agent, and at the meeting of the British Medical Association in London he read a short paper on the subject, and suggested that further enquiries should be made with regard to its pharmacological action.

After his return from India he served on a committee appointed to enquire into the effects of moisture in weaving sheds on the health of workers, and, in conjunction with Sir Henry Roscoe and Dr. Ransome, produced a report which has led to the settlement of a dispute of a serious character between employers and employed. He likewise undertook to represent the London University on the General Medical Council, and became a member of the Statutory Commission appointed in 1898 to deal with University teaching in London.

Though the subjects of indigestion and gout occupied his chief attention after he came to reside in London, he continued to interest himself in the investigations concerning urinary affections to which he had paid so much attention in the earlier portion of his career, and in 1893 published a paper on the influence of lactic acid fermentation as preventing under some conditions the decomposition of the urine, making at the same time a suggestion for the therapeutic use of this influence. He also contributed a useful paper to the *Practitioner* on the detection of minute traces of sugar.

The last published work of Sir William Roberts' life, the Harveian oration, which he delivered about eighteen months before his death, showed the philosophic spirit which animated him, and the high position in which he held science and experimental work. He pointed out how the development of science differentiated all anterior civilisations from that now existing, and he ventured to prophesy that this fact would prevent the wreckage which had occurred in connection with other civilisations, or at least, if it occurred, it would come about in quite a different manner. His activity continued unabated,

notwithstanding some evidence of failing health, and when seized with the illness which proved fatal, he was busily engaged in perfecting a new quantitative test for sugar which he had long had in mind, and in preparing a fifth edition of his work on kidney and urinary diseases.

He bore a long and trying illness with the patience and gentleness which were his distinguishing characteristics, and died on the 16th of April, 1899, in his 70th year. He was buried at Llanymawddy in Merionethshire, a village adjacent to his residence in Wales.

I shall forbear to repeat all the eulogiums on his character, which have appeared in the obituaries recently published. But it is fitting I should refer to some of the traits which specially distinguished him.

He delighted in experimental enquiry, and the happiest hours of his life were spent in his work room ; all the experiments he published were made with his own hand. He never employed an assistant, and to prevent the possibility of error he was accustomed to prepare himself the quantitative test solutions required for his investigations. He was by nature accurate in all things, in expression as well as in experiment. It was this accuracy of expression which rendered his writings so clear. He combined with this, however, a quaintness which gave a pleasant picquancy to everything he wrote, and he was, moreover, a happy coiner of words and phrases, for he was always searching for the best method of conveying his ideas briefly and correctly. He worked for the love of truth and the increase of knowledge, and never showed the slightest jealousy of other workers, or claimed a precedence in discovery which had been erroneously attributed to others. Controversy he disliked and almost altogether avoided, though he never shrank from criticising views which he thought scientifically defective. It was from probably his dislike of controversy that he never entered into medical politics. One solitary letter was his only contribution to medical politics.

Sir William Roberts brought to the practical part of his

professional work the clearness of judgment and the accuracy which characterised his scientific work. An acute clinical observer, he could look on all sides of the case. Hence his success as a consultant. He was scrupulously fair in his dealings with his professional brethren, and the high estimation in which he was held by them in Manchester was shown by the great pleasure which they evinced when he received the honour of knighthood, and by the deep regret which was evidenced when he left Manchester for London.

There was one side of his character not generally known, to which I may in conclusion allude. When he bought an estate in Wales he found it in a most unsatisfactory condition, so far as concerned the comfort and well-being of those who became his tenants. He at once set to work to remedy this. He rebuilt and restored the dilapidated houses of the farmers and labourers; he reduced rents where they were excessive, and did all in his power to promote the comfort and happiness of those on his estate; and he has left a name, not less loved in the district in which he lived, than in the profession to which he belonged.

D. J. Leech.

APPENDIX.

LIST OF SIR WILLIAM ROBERTS'S PUBLISHED WRITINGS,

COMPILED AND CHRONOLOGICALLY ARRANGED BY

CHARLES J. CULLINGWORTH, M.D.

1. An essay on wasting palsy (Cruveilhier's atrophy), xv, 210 pp, 4pl., 8vo., London, J. Churchill, 1858.

2. Cases of penetrating ulcers of the soft palate, "Brit. Med. Journ.," 1858, pp. 842-44.

3. History of a case of cystine calculus, with a description of a

second cystine calculus; together with an account of a quantitative determination of sulphur in cystine, "*Medical Times and Gazette*," vol. ii. 1858, pp. 626-27.

4. On the effect of food on the re-action of the urine. "*Proc. Lit. and Phil. Soc. of Manch.*," vol. i., No. 16, session 1858-9, Manch., pp. 137-140.

5. A contribution to urology, embracing observations on the diurnal variations in the acidity of the urine, chiefly in relation to food, "*Memoirs of the Literary and Philosophical Society of Manchester*," vol. xv, series ii, session 1858-9, Lond. 1860, pp. 238-98. (Rep., 61 pp., 8vo., Manch., 1859).

6. On some of the daily changes of the urine, "*Edin. Med. Journ.*" vol. v., 1859-60, pp. 817-25 and 906-23.

7. Notes on the treatment of diabetes, "*Brit. Med. Journ.*," 1860, pp. 878-80 and 898-900.

8. On the solvent powers of weak and strong solutions of alkaline carbonates on uric acid calculi, "Report of the 31st meeting of the Brit. Assoc. for the Advancem. of Science, held at Manch., Sept., 1861." Lond., 1862. Transactions of the sections, pp. 90-91. (Abstract) "*Archives of Medicine*," edit. by L. S. Beale, vol. iii, Lond., 1861-2, pp. 124-6.

9. On the occurrence of deposits of crystallised phosphate of lime in human urine, "*Brit. Med. Journ.*," vol. i, 1861, pp. 332-3. (Rep., 7 pp., 8vo., Manch., 1861).

10. On the estimation of sugar in diabetic urine by the loss of density after fermentation, "*Mem. Manch. Lit. and Philos. Soc.*," vol. i, series iii, session 1859-60, Lond., 1862, pp. 200-207; also "*Brit. Med. Journ.*," 1860, p. 925; "*Med. Circ.*" Dec. 19, 1860, p. 419, (Rep., 8 pp., 8vo., Manch., 1861).

11. A new clinical method of estimating the quantity of sugar in diabetic urine, "*Edin. Med. Journ.*," vol. vii, Edin. 1861-2, pp. 326-32.

12. Lectures on certain points in the clinical examination of the urine, "*Lancet*," vol. i, 1862.

i. On the discrimination of urinary deposits by the unaided senses, pp. 480-2.

ii. On qualitative sugar-testing in the urine, pp. 507-10.

iii. On quantitative sugar-testing in the urine, pp. 535-36.

13. On some of the more unusual forms of paralysis, "*Lond.*

Med. Rev.," vol. 1, Lond. 1860-61, pp. 212-22, 266-78, 307-12, 370-77.

14. On the histology of a recurring fibroid tumour, "Archives of Med.," edit. by L. S. Beale, vol. iii, Lond. 1861, pp. 66-70.

15. Homœopathy, as practised in Manchester, contrasted with its alleged principles, 84 pp., 12 mo., Manch., D. Kelly, 1862.

16. Consultations with homœopaths (Letters) "Lancet," vol. ii, 1862, pp. 73 and 126.

17. On the place of medicine among the sciences: introductory lecture, 20 pp., 8 vo., Manch., D. Kelly, 1862.

18. Two cases of double paralysis of the portio dura and portio mollis of the seventh pair, "Brit. Med. Journ.," vol. ii, 1862, pp. 355-58.

19. Clinical lecture on the successful use of iodide of potassium in the treatment of aneurism, *ibid.*, vol. i, 1863, pp. 83-85.

20. Clay v. Roberts, an action for libel (Letter to the editor of the "Manch. Examiner and Times") *ibid.*, vol. i, 1863, pp. 517-18, (see also summary of proceedings at trial, *ibid.*, p. 525).

21. The glucogenic theory: its present state (abstract), *ibid.*, vol. ii, 1863, p. 432.

22. The effect of a solution of magenta on the blood, "Proc. Lit. and Phil. Soc. of Manch.," vol. iii., No. 2, session 1862-3, p. 9.

23. The use of colouring materials in the examination of the structure of animal and vegetable tissue, *ibid.*, vol. iii., No. 4, session 1862-3, p. 30.

24. Blood-corpuscles from an albuminous urine, showing an appearance as if the contents of the cells had separated from the cell-wall and become aggregated round the centre like a nucleus, *ibid.*, vol. iii., No. 11, session 1862-3, p. 101.

25. On peculiar experiences exhibited by blood corpuscles under the influence of solutions of magenta and tannin, "Proc. Roy. Soc." xii, Lond. 1863, pp. 481-91, (Rep., 10 pp., 8 vo., Lond. 1863).

26. Traumatic nephritis (abstract), "Brit. Med. Journ.," vol. i, 1864, p. 430.

27. On the solvent treatment of urinary calculi: an experimental and clinical enquiry, "Med. Chir. Trans.," vol. xlviii, Lond., 1865, pp. 89-134, (Rep., 45 pp., 1 plate, 8 vo., Lond. 1865).

28. A practical treatise on urinary and renal diseases, including

urinary deposits, xx, 523 pp., 8 vo., Lond., Walton and Maberly, 1865.

2nd edition, xx, 622 pp., 8vo., Lond., 1872.

3rd edition, xx, 632 pp., 8vo., Lond., 1876.

4th edition, with the assistance of R. Maguire, xx. 697 pp., 1 pl., 8 vo., Lond., Smith & Elder, 1885.

29. A case of fungus hæmatodes of the liver, "Lancet," vol. i, 1867, pp. 77-79.

30. "Wasting palsy," article in "Reynolds's System of Medicine," vol. ii, Lond., 1868, pp. 334-51.

31. The pathology of suppression of urine, illustrated by two cases, "Lancet," vol i, 1868, pp. 653-5 and 682-3.

32. A case of aneurism of the ascending aorta communicating with the pulmonary artery, "Brit. Med. Journ.," vol. i, 1868, pp. 421-2.

33. A case of double hydronephrosis causing suppression of urine and intestinal obstruction, *ibid.*, vol. 1, 1868, pp. 582-3 and 605-6.

34. On tapping with the aid of siphon-power, "Med. Times and Gaz.," vol. 1, 1868, pp. 34-5 and 63-4.

35. On the mode of electing the general council of the [Brit. Med.] Association (Letter), "Brit. Med. Journ.," vol. ii, 1868, pp. 119-20.

36. The pathology of suppression of urine: with a case, "Lancet," vol. i, 1870, pp. 868-70.

37. Cases of motiveless simulation of disease, "Brit. Med. Journ.," vol. i, 1870, pp. 306-7.

38. A case of disease of the lymphatics of the abdominal integuments, with occasional discharge of large quantities of chylous fluid, "Manch. Med. and Surg. Reports," Manch., 1870, pp. 104-122, (Rep., 18 pp., Manch., 1870).

39. On obstructive suppression of urine, *ibid.*, Manch., 1870, pp. 231-259, (Rep., 29 pp., 8 vo., Manch., 1870).

40. Alteration of laws [of the Brit. Med. Assoc.] (Letter) "Brit. Med. Journ.," vol. ii, 1871, p. 165.

41. On intemperance as a cause of chronic Bright's disease, *ibid.*, vol. ii, 1871, pp. 521-2.

42. On the treatment of pyrexia by a cooling pad (with diagram). "Med. Times and Gaz.," vol. ii, 1871, pp. 733-35.

43. Alcohol as a cause of Bright's disease, and Dr. Dickinson's statistics, "*Brit. Med. Journ.*," vol. ii, 1872, pp. 653-4.
44. Clinical remarks on hydatid cysts, "*Liverpool and Manchester Med. and Surg. Reports*," 1873, Manch., Liverp., and Lond., 1873, pp. 18-22.
45. On exploring and tapping, *ibid.*, pp. 66-76, (Rep., 12 pp., 8vo., Manch., 1873.)
46. Preparations and experiments bearing on the question of biogenesis, "*Proc. Lit. and Phil. Soc. of Manch.*," vol. xii., No. 5, session 1872-3, pp. 52-55.
47. Clinical pocket-book: an aid to the study of clinical medicine for the use of students of the Manchester Royal Infirmary, crown 6vo., 30 pp., Lond., Smith, Elder & Co., 1874.
48. Studies on biogenesis, "*Proc. Roy. Soc.*," 22, 1874, pp. 289-91, "*Phil. Trans.*," 164, 1874, pp. 457-77.
49. A word on the origin of bacteria and on abio-genesis, "*Brit. Med. Journal.*," vol. i, 1876, pp. 282-3.
50. On the estimation of albumen in urine by a new method adapted for clinical purposes, "*Med. Chir. Trans.*," vol. lix, 1876, pp. 141-47, and "*Med. Chir. Proceedings*," 8, 1880, pp. 48-50.
51. Note on the influence of liquor potassæ and an elevated temperature on the origin and growth of microphytes [1876], "*Proc. Roy. Soc.*," 25, 1877, pp. 454-56.
52. The respirator-inhaler, "*Brit. Med. Journ.*," vol. i, 1877, p. 132.
53. The doctrine of contagium vivum and its applications to medicine: the address in medicine delivered at the meeting of the Brit. Med. Assoc., Manch., 1877, "*Quart. Journ. Microsc. Science*," vol. xvii, 1877, pp. 307-29; also, "*Brit. Med. Journ.*," vol. ii, 1877, pp. 168-173; and *Med. Times and Gaz.*," vol. ii, 1877, pp. 138-145, (Rep., under the title "On spontaneous generation and the doctrine of contagium vivum," 42 pp., 8vo., Lond., 1877).
- 54-56. "Hæmaturia," "Endemic hæmaturia," "Hæmatinuria and paroxysmal hæmatinuria," articles in "*Reynolds's Syst. of Med.*," vol. v, Lond., 1879, pp. 452-72.
57. "Albuminuria," *ibid.*, pp. 473-82.
58. "Congestion of the kidneys," *ibid.*, pp. 483-89.
59. "Bright's disease," *ibid.*, pp. 490-528.

60. "Anomalies of position, form, and number of the kidneys," *ibid.*, pp. 639-49.

61. Cases of hysteria in boys, "*Practitioner*," vol. xxiii, Lond., 1879, pp. 339-45.

62. A contribution to the therapeutics of starch digestion, *ibid.*, vol. xxiii, pp. 401-409.

63. Malt extracts (Letter), "*Med. Times and Gaz.*," vol. i, 1879, p. 573.

64. Observations on the digestive ferments and their therapeutical uses, "*Brit. Med. Journ.*," vol. ii, 1879, pp. 683-5, and 724-5.

65. Note on the existence of a milk-curdling ferment in the pancreas, "*Proc. Roy. Soc.*," 29, 1879, p. 157.

66. Peptonised beef-tea (Note), "*Brit. Med. Journ.*," vol. i, 1880, p. 815.

67. Pancreatised papers (Note), *ibid.*, vol. ii, 1880, p. 851.

68. On the digestive ferments and artificially digested food, being the Lumleian lectures for the year 1880, before the Roy. Coll. of Physicians, 112 pp., 8 vo., Lond. and Manch., 1880.

2nd edit., revised with additions, vii, 74 pp., crown 8 vo., Lond. and Manch., 1881.

also, "*Lancet*," vol. i, 1880, pp. 513-15, 549-52, 589-91, 629-31, 669-70, 705-6, 753-54.

"*Brit. Med. Journ.*," vol. i, 1880, pp. 539-44, 575-77, 614-16, 647-49, 683-85.

"*Med. Times and Gaz.*," vol. i, 1880, pp. 363-65, 391-94, 471-74, 523-24, 549-51, 575-77.

"*Med. Press and Circ.*," n.s., vol. xxix, 1880, pp. 275, 295, 317, 339, 361, and 383.

69. On the estimation of the amylolytic and proteolytic activity of pancreatic extracts, "*Proc. Roy. Soc.*," 32, 1881, pp. 145-161; 33, 1882, p. 147.

70. Case of hepatic abscess (jointly with F. A. Heath), "*Lancet*," vol. i, 1881, p. 371.

71. On the occurrence of micro-organisms in fresh urine, "*Brit. Med. Journ.*," vol. ii, 1881, pp. 623-25.

72. On some new articles of peptonised food, prepared by the pancreatic method, "*Trans. Intern. Med. Congress*," vol. i, Lond., 1881, pp. 517-19.

73. On bacilluria, a form of urinary disorder associated with the

discharge of rod-shaped bacteria with the urine, *ibid.*, vol. ii, Lond., 1881, pp. 157-63.

74. On a new test for albumen in urine, "*Lancet*," vol. ii, 1882, pp. 613-14.

75. Some new ways of testing for albumen in the urine (abstract), "*Brit. Med. Journ.*," vol. ii, 1882, p. 844.

76. Micrococci from fresh urine (Note), *ibid.*, vol. i, 1882, p. 53.

77. "Peptonised food," article in "*Quain's Dict. of Med.*," Lond., 1882.

78. On collective investigation of disease: an address, "*Brit. Med. Journ.*," vol. ii, 1883, pp. 860-61.

79. Albuminuria, its pathology and clinical significance (Remarks in discussion on, at Glasg. Path. and Clin. Soc.), *ibid.*, vol. 1884, p. 320.

80. On tests for albumen in urine, new and old, "*Med. Chron.*," vol. i, Manch., 1884-5, pp. 1-4.

81. Lectures on dietetics and dyspepsia, delivered at the Owens College, Manchester, ix, 92 pp., 8vo., Lond., 1885.

2nd edit. ix, 92 pp., 8vo., Lond., 1886.

82. On feeding the sick: address in therapeutics delivered before the Brit. Med. Assoc. at Cardiff, 1885, "*Brit. Med. Journ.*," vol. ii, 1885, pp. 188-92.

83. On the chemical constitution and physiological relations of the amorphous urate deposits, "*Med. Chron.*," vol. vii, Manch., 1887-8, pp. 441, 49.

84. Moderate drinking (Letter), "*Brit. Med. Journ.*," vol. ii, 1888, pp. 202-3.

85. On some practical points in the use of antacid remedies in dyspepsia and gravel: address delivered at the opening of the section of pharmacology and therapeutics at the meeting of the Brit. Med. Assoc. at Leeds, 1889, "*Brit. Med. Journ.*," vol. ii, 1889, pp. 373-75.

86. The prophylaxis of uric acid gravel: inaugural address delivered before the Nottingham Medico-chirurgical Society, Oct. 16, 1889, "*Lancet*," vol. ii, 1889, pp. 900-1.

87. On some points in dietetics: an address delivered at the opening of the current session of the Manchester Medical Society, "*Brit. Med. Journ.*," vol. ii, 1890, pp. 883-85.

88. A contribution to the chemistry of gout, "*Med. Chir. Trans.*," vol. lxxiii, Lond., 1890, pp. 339-57.

89. On the history of uric acid in the urine, with reference to the formation of uric acid concretions and deposits, *ibid.*, vol. lxxiii, Lond., 1890, pp. 245-71.

90. On Pfeiffer's test for latent gout, "*Lancet*," vol. i, 1890, pp. 9-10.

91. Collected contributions on digestion and diet, 262 pp., crown 8 vo., Lond., 1891.

2nd edit., with an appendix on the opium habit in India, xiv, 322 pp., crown 8vo., Lond., 1897.

92. On the deposition of the crystalline urates in the tissues considered as a separate pathological incident, with a suggestion for a distinctive name, "*Trans. Med. Soc. Lond.*," vol. xiv, 1891, pp. 84-91; also, "*Brit. Med. Journ.*," vol. ii, 1890, pp. 1163-64.

93. On the chemistry and therapeutics of uric acid gravel and gout, being the Croonian lectures for 1892 delivered before the Roy. Coll. of Physicians, with additions, viii, 136 pp., sm. 8vo., Lond., 1892; also, "*Brit. Med. Journ.*," vol. i, 1892, pp. 1285-90, 1347-52; vol. ii, 1892, pp. 6-11, 61-65; and "*Lancet*," vol. i, 1892, pp. 1345-50, 1399-1404, and vol. ii, 1892, pp. 69-73, 127-31.

94. A case of lactic fermentation in the bladder, with suggestions for the use of the lactic fermentation as a counter-septic agent in cases of ammoniacal decomposition of the urine, and in the treatment of putrefactive wounds and sores, "*Lancet*," vol. i, 1893, pp. 405-6.

95. A memorandum on the general features and the medical aspects of the opium habit in India: an annexure to the "Final Report of the Royal Commission on opium" [appointed in 1893], vol. vi, Part 1, Lond., 1895, pp. 99-119.

96. On anarcotine, a neglected alkaloid of opium: an address delivered at the opening of the section of pharmacology and therapeutics at the annual meeting of the Brit. Med. Assoc. at London, 1895, "*Brit. Med. Journ.*," vol. ii, 1895, pp. 405-6.

97. On the verification of sugar testing in the urine, "*Practitioner*," vol. iii, n.s., Lond., 1896, pp. 11-14, (Rep. 4 pp., 8vo., Lond., 1896).

98. "Gout," article in "*Allbutt's Syst. of Med.*," vol. iii, Lond., 1897, pp. 155-195.

99. Science and modern civilization; the Harveian oration delivered before the Roy. Coll. of Physicians, Oct. 18, 1897, 8vo., 32 pp., Lond., 1897; also, "Brit. Med. Journ.," vol. ii, 1897, pp. 1167-71; "Lancet," vol. ii, 1897, pp. 1025-29.



